

Name: Maths Class:

SYDNEY TECHNICAL HIGH SCHOOL



Year 11 Mathematics

Preliminary Course

Assessment 1

April, 2015

Time allowed: 70 minutes

General Instructions:

- Marks for each question are indicated on the question.
- Approved calculators may be used
- All necessary working should be shown
- Full marks may not be awarded for careless work or illegible writing
- **Begin each question on a new page**
- Write using black or blue pen
- All answers are to be in the writing booklet provided

Section I Multiple Choice
Questions 1-5
5 Marks

Section II Questions 6-13
56 Marks

SECTION 1

5 Marks

Attempt questions 1-5

Use multiple choice answer sheet

1. What are the solutions of $2x^2 - 5x - 1 = 0$

(A) $x = \frac{-5 \pm \sqrt{17}}{4}$ (C) $x = \frac{-5 \pm \sqrt{33}}{4}$

(B) $x = \frac{5 \pm \sqrt{17}}{4}$ (D) $x = \frac{5 \pm \sqrt{33}}{4}$

2. Which inequality defines the domain of the function $f(x) = \frac{1}{\sqrt{x+3}}$?

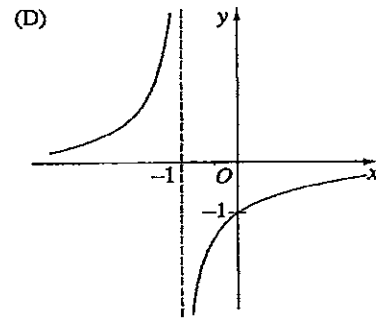
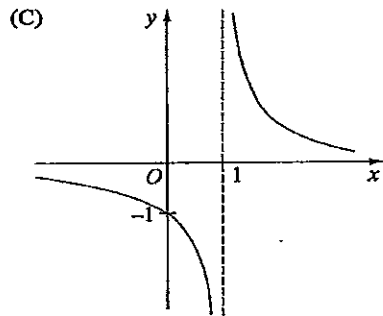
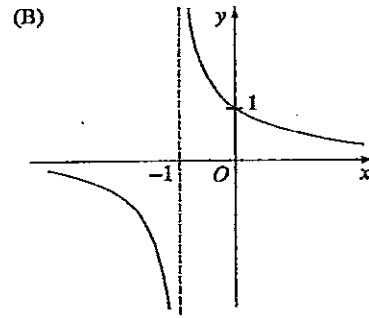
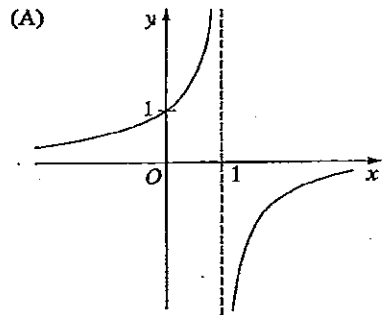
(A) $x > -3$ (C) $x < -3$

(B) $x \geq -3$ (D) $x \leq -3$

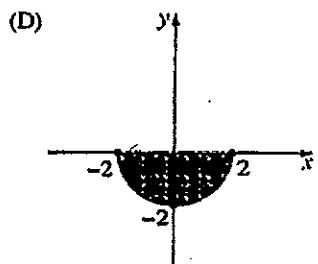
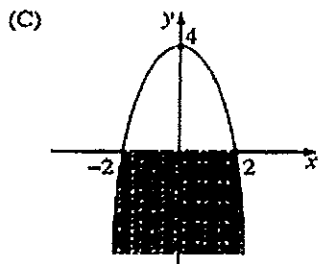
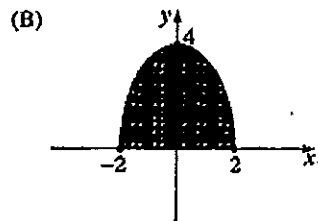
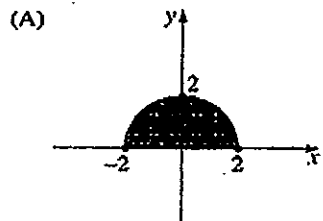
3. What is 4.09784 correct to three significant figures?

(A) 4.09 (B) 4.10 (C) 4.097 (D) 4.098

4. Which of the following graphs represents $y = \frac{1}{1-x}$?



5. Which diagram shows the region in the plane defined by $y \geq 0$ and $y \leq 4 - x^2$?



SECTION 2

Marks

56 Marks

Attempt questions 6-13

Marks are indicated next to question.

Start each question on a new page.

QUESTION 6 - (7 Marks)

- (a) Evaluate $\frac{1}{(1.04)^9 - 1}$ correct to 3 decimal places 2
- (b) Find $(2\sqrt{5})^3$ as an exact value 1
- (c) Simplify $\frac{b-a}{a-b}$ 1
- (d) Find the exact value of $8^{-2/3}$ 1
- (e) Solve $3 - x \leq 4$ and sketch the solution on a number line 2

QUESTION 7 - (7 Marks)

(Start a new page)

Marks

- (a) Draw a neat sketch (with a ruler) of $(x - 1)^2 + (y + 2)^2 = 9$ and state the domain and range. 3
- (b) Solve $|2x - 1| > 9$ 2
- (c) Determine whether the function $f(x) = \frac{2x}{x^2+1}$ is odd, even or neither 2

QUESTION 8 – (7 marks)

(Start a new page)

Marks

(a) Express $\frac{2\sqrt{3}}{2-\sqrt{3}}$ in the form $a + \sqrt{b}$

2

(b) If $f(x) = 8 - x^3$, find the value of

(i) $f(2)$

1

(ii) x if $f(x) = 35$

2

(c) Simplify $\sqrt{\frac{a^3b^7}{a^5b^3}}$

2

QUESTION 9 – (7 marks)

(Start a new page)

Marks

(a) Factorise fully:

(i) $x^3 - 4x$

2

(ii) $ay - 3a + y^2 - 3y$

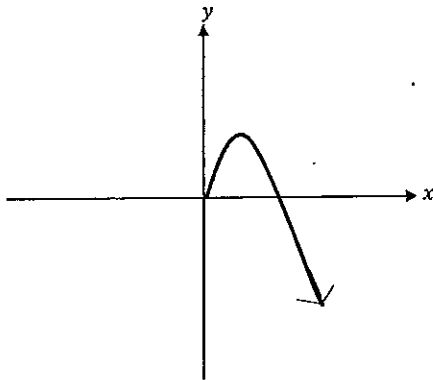
2

(iii) $8x^3 - 27$

2

(b) The diagram shows part of a function $y = f(x)$

1



Copy or trace this diagram onto your answer sheet.

Complete the graph of $y = f(x)$ given that it is an odd function.

QUESTION 10 – (7 marks)

(Start a new page)

Marks

(a) Solve the following equations

(i) $2x^2 - 5x + 3 = 0$

2

(ii) $\frac{x-4}{3} + 2 = \frac{3x}{5}$

2

(iii) $|x + 1| = 5 - 3x$

3

QUESTION 11 – (7 marks)

(Start a new page) Marks

(a) For the parabola $y = x^2 + 4x + 3$, find

(i) the y intercept

1

(ii) the x intercepts

2

(iii) the coordinates of the vertex. $-\frac{b}{2a}$

2

(iv) Sketch the parabola showing all important features

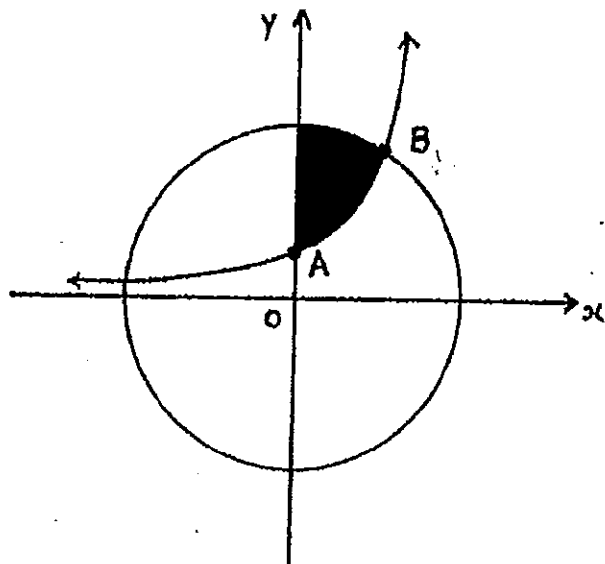
2

QUESTION 12 – (7 marks)

(Start a new page)

Marks

- (a) A circle, centre the origin, and an exponential function of the form $y = a^x$ are shown on the diagram below. A and B lie on the curves as shown. B has coordinates (1,3)



Find

- (i) the coordinates of A. 1
- (ii) the equation of the circle. 2
- (iii) the equation of the exponential function. 1
- (iv) Give the three inequations which describe the shaded region above. 3

QUESTION 13 – (7 marks)

(Start a new page)

Marks

- (a) Sketch $y = 1 - \frac{1}{x-2}$ on a number plane showing all important features. Use a ruler. 2
- (b) Factorise $(a + b)^2 - a - b$ fully. 2
- (c) Simplify $\frac{a^{-1} + b^{-1}}{a^{-2} - b^{-2}}$ 3

END OF PAPER

Student Name: _____

Teacher Name: _____

Year 11 2015 2 Unit

Task 1 Solutions

1. D 2. A 3. B 4. A 5. B

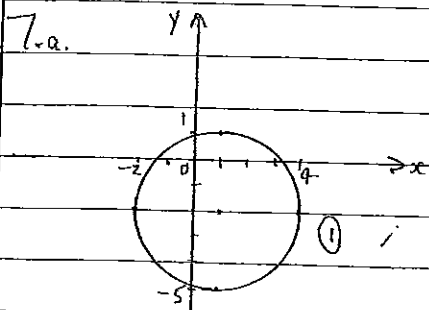
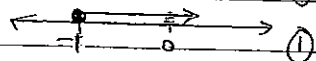
6. a. $2 \cdot 36 \cdot 20$ b. $8 \times 5 \sqrt{5}$ c. $\frac{b-a}{a-b}$ d. $\frac{1}{8^{3/2}}$

① for 3 d.p. $40 \sqrt{5}$ $= \frac{-(a-b)}{a-b} = -1$ $\frac{1}{2^2} = \frac{1}{4}$

e. $3 - x \leq 4$

$-x \leq 1$

$x \geq -1$ ①



b. $|2x - 1| > 9$

$$2x - 1 > 9 \quad \text{or} \quad 2x - 1 < -9$$

$$2x > 10 \quad ; \quad 2x < -8$$

$$x > 5 \quad \text{①} \quad ; \quad x < -4 \quad \text{①}$$

D: $-2 \leq x \leq 4$ ①

R: $-5 \leq y \leq 1$ ①

c. $y = \frac{2x}{x^2+1}$

Odd if

$f(-x) = -f(x)$ ①

$$f(-x) = \frac{2x-x}{(-x)^2+1}$$

$$= \frac{-2x}{x^2+1}$$

$$= -\frac{2x}{x^2+1} \quad \therefore f(x) \text{ is odd}$$

① $= -f(x)$

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8. a. $\frac{2\sqrt{3}}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}}$

$$= \frac{4\sqrt{3} + 6}{1}$$

$= 6 + \sqrt{48} = a + \sqrt{b}$

$a = 6$ ①, $b = 48$ ①

b. i) $f(x) = 8 - x^3$

$f(2) = 8 - 2^3 = 0$

ii) $35 = 8 - x^3$

$x^3 = -27$ ①

$x = -3$ ①

c. $\sqrt{\frac{a^3 b^7}{a^5 b^3}}$

$$= \sqrt{\frac{b^4}{a^2}}$$

$$= \frac{b^2}{a}$$
 ①

9. a. i) $x^3 - 4x$

$x(x^2 - 4)$ ①

$x(x-2)(x+2)$ ①

ii) $ay - 3a + y^2 - 3y$

$$a(y-3) + y(y-3)$$

$$(y-3)(a+y)$$
 ①

d. i) $8x^3 - 27$

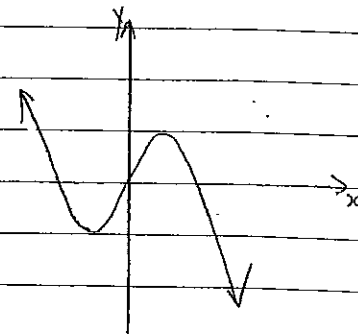
$(2x)^3 - 3^3$

$(2x-3)(4x^2+6x+9)$ ②

give one for

$(2x+3)(4x^2-6x+9)$

b.



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10. a. (i) $2x^2 - 5x + 3 = 0$
 $(2x-3)(x-1) = 0$ ①
 $x = \frac{3}{2}, 1$

(ii) $\frac{x-4}{3} + 2 = \frac{3x}{5}$
 $5(x-4) + 30 = 3 \times 3x$
 $5x - 20 + 30 = 9x$ ①
 $10 = 4x$
 $x = 2\frac{1}{2}$ ①

(iii) $|x+1| = 5-3x$
 $x+1 = 5-3x, x+1 = -(5-3x)$ ①
 $4x = 4 \quad x+1 = -5+3x$
 $x = 1 \quad 6 = 2x$
 $x = 3$ ①

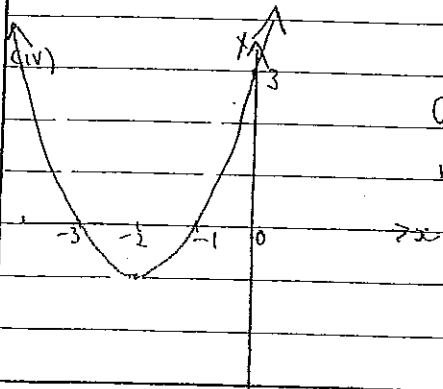
Need to check solutions.

Only solution is $x=1$ ①

11. a. (i) $y = x^2 + 4x + 3$
 y intercept is 3

(ii) When $y=0$
 $0 = x^2 + 4x + 3$
 $0 = (x+1)(x+3)$
 $x = -1$ or -3 sub. in $(-2, -1)$ ①

(iii) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
 $= \frac{-4 \pm \sqrt{16 - 12}}{2}$
 $= -2$ ①



Only ① if intercepts not marked.

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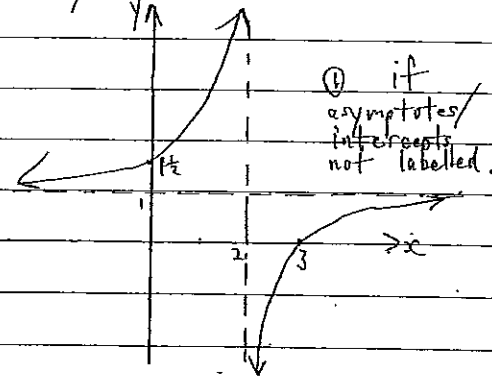
Teacher Name: _____

12. (a) (i) $(0, 1)$ (ii) radius of circle
 is $\sqrt{1^2 + 3^2} = \sqrt{10}$ ①
 \therefore Equation is
 $x^2 + y^2 = 10$ ①

(iii) $y = a^x$ passes through $(1, 3)$
 $3 = a^1$
 $\therefore a = 3$
 $y = 3^x$

(iv) $x^2 + y^2 \leq 10$
 $x \geq 0$
 $y \geq 3^x$

13. a. $y = 1 - \frac{1}{x-2}$ b. $(a+b)^2 - (a+b)$ ①
 $(a+b)(a+b-1)$



c. $\frac{a^{-1} + b^{-1}}{a^{-2} - b^{-2}} = \frac{\frac{1}{a} + \frac{1}{b}}{\frac{1}{a^2} - \frac{1}{b^2}}$
 $= \frac{a+b}{ab} = \frac{b^2 - a^2}{a^2 b^2}$ ①
 $= \frac{a+b}{ab} \times \frac{a^2 b^2}{(b-a)(b+a)}$ ①
 $= \frac{ab}{b-a}$ ①